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(54) METHOD FOR TREATING PRINTED CIRCUIT BOARD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a method for treating a printed circuit board which is easy of treatment in disposal. SOLUTION: A printed circuit board containing at least a phenol resin is immersed in an alkaline aqueous solution to swell the resin so that metal foil such as copper foil can be peeled off easily from the board. Not only the metal foil but also mounted parts can be separated easily from the board. By immersing the board in water after the immersion in an alkaline aqueous solution, the swelling of the resin is promoted by utilizing osmotic pressure difference to facilitate the separation and removal of metal foil and parts.

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TI Treatment of waste printed **circuit board** containing phenolic resin substrates for removing metals for **recovery** or disposal
IN Yamagata, Yoshikazu; Terada, Takahiko; Shiino, Toru; Onishi, Hiroshi; Sonoda, Nobuo
PA Matsushita Electric Industrial Co., Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 5 pp.
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LA Japanese
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AB The title printed **circuit board** is soaked in alk. aq. solns. for peeling metal wiring part, and then optionally soaked in water.
Phenolic resins soaked in alk. aq. solns. are swelled and the metal wiring can be easily peeled.
ST waste printed **circuit board** treatment; **recovery** metal wiring printed **circuit board**; phenolic resin printed **circuit board** disposal
IT Phenolic resins, processes
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)
(substrates; treatment of waste printed **circuit board** contg. phenolic resin substrates for removing metals for **recovery** or disposal)
IT Printed **circuit boards**
Recycling
Wastes
(treatment of waste printed **circuit board** contg. phenolic resin substrates for removing metals for **recovery** or disposal)
IT **1310-73-2**, Sodium hydroxide, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(in treatment of waste printed **circuit board** contg. phenolic resin substrates for removing metals for **recovery** or disposal)
IT 7440-50-8, Copper, processes
RL: DEV (Device component use); REM (Removal or disposal); PROC (Process);
USES (Uses)
(wiring; treatment of waste printed **circuit board** contg. phenolic resin substrates for removing metals for **recovery** or disposal)

DERWENT-ACC-NO: 1997-419794

DERWENT-WEEK: 199739

TITLE: Method of treating waste printed-circuit boards - involves immersing in aq. basic solution then in water, repeating if necessary

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ABSTRACTED-PUB-NO: JP 09187751A

BASIC-ABSTRACT:

(1) Waste printed-circuit boards (A) contg. at least phenol resin are immersed into basic aqueous soln. (B). (2) After treating with (B), (A) is immersed into water, and the processes are carried out at least once. (3) (A), to whom various parts are attached, at least one part of them are removed prior to the treatment with (B).

USE - Used for treating waste printed-circuit boards.

ADVANTAGE - This method is able to treat waste printed-circuit boards without using conventional mechanical grinding process, to separate into Cu foils and resin base plates.

CHOSEN-DRAWING: Dwg.0/0

TITLE-TERMS: METHOD TREAT WASTE PRINT CIRCUIT BOARD IMMERSE AQUEOUS BASIC SOLUTION WATER REPEAT NECESSARY

DERWENT-CLASS: A35 A85 L03 P43 V04

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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the art which performs immersion down stream processing of being immersed in water, once [at least] or more, after being immersed in the art immersed in an alkaline water solution, or an alkaline water solution in the printed circuit board which contains phenol resin at least.
[0002]
[Description of the Prior Art] As printed circuit boards, such as a common noncommercial electrical machinery and apparatus, although the paper base phenolic laminated sheet and the cloth base material phenolic laminated sheet are used widely, after dissociating from a product, it is common [these substrates] at the time of product abandonment that crush or reclamation processing is carried out into soil as it is together with a product.
[0003]
[Problem(s) to be Solved by the Invention] Many copper clad laminates to which copper wiring was given are used for printed circuit boards, such as a paper base phenolic laminated sheet and a cloth base material phenolic laminated sheet, and IC chip, a capacitor, resistance, switches, and connectors are mainly mounted in them using solder. The present condition is crushing and that reclamation processing is carried out with the condition, and since the elution of the lead from solder etc. is taken up as an environmental problem and recovery of valuable metals, such as copper, is not performed, either, it has been a problem also from the point of a deployment of a resource.
[0004] However, only by such a printed circuit board carrying out crushing processing simply, a metal and resin cannot fully be separated but recycle is difficult.
[0005] Then, this invention aims to let the processing at the time of abandonment offer the art of an easy printed circuit board.
[0006]
[Means for Solving the Problem] This invention is the art of the printed circuit board characterized by immersing the printed circuit board which contains phenol resin at least in an alkaline water solution.
[0007] Moreover, it is the art of the printed circuit board characterized by performing

immersion down stream processing that the printed circuit board which contains phenol resin at least is immersed in water after being immersed in an alkaline water solution, once [at least] or more.

[0008] Moreover, it is the art of the printed circuit board characterized by being immersed in an alkaline water solution and exfoliating said metal wiring section about the printed circuit board containing the phenol resin with which an unit or two or more components are mounted in the metal wiring section after removing said some of components [at least].

[0009]

[Embodiment of the Invention] If the printed circuit board with which this invention is presented is a printed circuit board containing phenol resin, any will be sufficient, for example, a paper base phenolic laminated sheet, a cloth base material phenolic laminated sheet, a glass fabric base material phenolic laminated sheet, an asbestos base material phenolic laminated sheet, a synthetic-fiber base material phenolic laminated sheet, etc. will be mentioned.

[0010] Of course, components, such as IC chip, a capacitor, resistance, switches, and connectors, may be mounted in these printed circuit boards, and resists, adhesive tape, etc., such as a photoresist and a screen-stencil mold resist, may be attached to them.

[0011] Furthermore, coating of these printed circuit boards may be carried out with the coating material invaded by alkali. As a coating material invaded by this alkali, polyurethane, silicone, an acrylic, isobutylene isoprene rubber, etc. are mentioned, for example.

[0012] Moreover, most may use conductive metallic foils, such as silver, aluminum, and nickel, for wiring of a printed circuit board besides it, although copper foil is used.

[0013] Moreover, the adhesives currently generally used may be used, as thermosetting resin, there are phenol resin, an epoxy resin, REJIRUSHI Norian resin, etc., and there are a polyvinyl butyral, nitrile rubber, etc. in the adhesives which are making these metallic foils and substrates rival as thermoplastics, for example. Polyvinyl-butyral denaturation phenol resin, acrylic nitrile rubber denaturation phenol resin, a modified epoxy resin, etc. are still more specifically mentioned.

[0014] The alkaline water solution with which this invention is presented is a water solution containing an alkaline alkali metal compound or an alkaline alkaline-earth-metal compound. As an alkaline alkali metal compound or an alkaline alkaline-earth-metal compound, a sodium hydroxide, a potassium hydroxide, a barium hydroxide, a sodium ethoxide, potassium butoxide, etc. are mentioned, for example. Although the adhesives which are making phenol resin, a resist and the metallic foil for wiring, and the substrate rival are invaded so that the concentration of the solution of these alkaline alkali metal compounds or an alkaline alkaline earth metal compound is large, since sodium ion, potassium ion, etc. increase in number, the viscosity of a solution also becomes high, and the permeability of the liquid to the inside of a printed circuit board falls. Therefore, concentration to which resin etc. is invaded enough and the permeability of liquid is not reduced, either is desirable. Then, the solution concentration of an alkaline alkali metal compound or an alkaline alkaline-earth-metal compound has desirable 10Ns or less, and

2-especially its 7N are more desirable.
[0015] In addition, two or more these alkaline alkali metal compounds or alkaline alkaline-earth-metal compounds may be contained only not only in the single component.
[0016] Moreover, in order to improve the permeability over the printed circuit board of a solution For example, alcohols, such as methyl alcohol and ethyl alcohol, An acetone, a tetrahydrofuran, ethylene glycol, ethylene glycol monoethyl ether, Ethylene glycol wood ether, ethylene glycol diethylether, A diethylene glycol, diethylene-glycol diethylether, diethylene-glycol wood ether, the diethylene-glycol monomethyl ether, diethylene glycol monoethyl ether, dimethylformamide, dimethylamine, etc. may be added.
[0017] Moreover, although it is more desirable to warm processing temperature by within the limits below the boiling point of water (ordinary pressure 100 degrees C or less) since an osmosis rate with the bigger elevated temperature is obtained, when alcohols are contained, below those boiling points are desirable. When immersed in water after alkaline water-solution immersion, the highest possible temperature of the temperature of the water is also better at below the boiling point.
[0018] In the art immersed in an alkaline water solution among this inventions, phenol resin, a resist and the metallic foil for wiring, the adhesives of a substrate, coating, etc. are invaded by alkali, and decomposition, the dissolution, swelling, etc. occur. Therefore, swelling of a printed circuit board, softening, exfoliation of a laminate, exfoliation of the metallic foil for wiring, exfoliation of coating, etc. are promoted, and it becomes possible to separate a printed circuit board and the metallic foil for wiring easily. By this, the components mounted in the printed circuit board can also be easily removed now, and mounting components, the metallic foil for wiring, and a phenol resin substrate can be separated. Since each separated thing can be processed separately respectively, it becomes suitable processing and playback, and reusable. Since most especially solder has adhered to the metallic foil, by processing appropriately, the load to an environment can be made small and recycle of metallic foils, such as copper, is also attained.
[0019] moreover, in the art which performs immersion down stream processing of being immersed in water, once [at least] or more after being immersed in an alkaline water solution among the arts of this invention In the condition of having made the alkaline water solution permeating into a printed circuit board, by being immersed in water Make the liquid of the interior of a printed circuit board, and the exterior produce osmotic pressure difference, tend to cancel the osmotic pressure difference, and a lot of water infiltrates into the interior of a printed circuit board. It enables them to promote further swelling of a printed circuit board, softening, exfoliation of a laminate, etc., and to carry out exfoliation removal of the metallic foil for wiring from a printed circuit board more easily.
[0020] Moreover, since the degree of hardness is falling greatly, the phenol resin substrate after processing can be ground easily, and can create a pulverizing article by low energy. In this grinding, the phenol resin substrate of a condition [having become wet after processing] is put into impact type pulverizers, such as grinding type grinders, such as a grinder, and a hammer mill, a ball mill, a mixer, etc., and it can grind easily. Moreover, in order to avoid the coagulation at the time of desiccation of a pulverizing article etc., use of a spray type dryer is desirable. Thus, the created pulverizing article is reusable to a filler

etc.

[0021] A concrete example is given below and this invention is explained more to a detail. (Example 1) In this example, the paper base phenolic laminated sheet (30x30x thickness of 1.5mm), the cloth base material phenolic laminated sheet (30x30x thickness of 1.5mm), and the glass base material phenolic laminated sheet (30x30x thickness of 1.5mm) were used as a printed circuit board. Polyvinyl-butyral denaturation phenol resin is used for one side of these substrates, copper foil with a thickness of 35 micrometers was pasted up on it, the Kushigata electrode of 0.3mm pitch was created, and eutectic solder was made to adhere to several of the places.

[0022] Immersion processing of these three kinds of printed circuit boards was carried out at 80 degrees C for 20 hours at the 5-N sodium-hydroxide water solution. The thickness of the substrate before and behind immersion processing and weight were measured. The thickness rate of change and weight rate of change of a substrate after the immersion processing to the substrate before immersion processing are shown in (Table 1).

[0023]

[Table 1]

単位：%

	[illegible]	[illegible]	[illegible]
[illegible]	+807	+293	+200
[illegible]	+180	+121	+75

[0024] From this result, it saw, and the increment swelled thickness and weight and deformed them for every substrate for a while. Moreover, since a part of copper foil exfoliated, and every substrate was turned over and went up, when the pincette pulled that, while copper foil could be exfoliated and solder had also adhered to copper foil easily, it has removed. Compared with the glass base material phenolic laminated sheet, exfoliation removal of copper foil of a paper base phenolic laminated sheet or a cloth base material phenolic laminated sheet was completed especially more easily.

[0025] A printed circuit board is easily separable into a laminate and a conductive metallic foil with this.

(Example 2) In this example, suitable wiring was created by the copper foil used for the example 1 to the paper base phenolic laminated sheet (50x50x thickness of 1.5mm), and the printed circuit board which mounted one IC chip, ten resistance, three capacitors, and one connector with soldering at one side of a substrate was created.

[0026] Immersion processing of this printed circuit board was carried out at 80 degrees C for 20 hours at the 5-N sodium-hydroxide water solution.

[0027] Consequently, a printed circuit board swells, a resist separates completely, and, only for exfoliation, some laminates are beams. Moreover, when as for a part of copper foil the beam part was seen and only exfoliation pulled the exfoliation part with the pincettes, copper foil has exfoliated with solder. Therefore, when the pincette pulled the mounted components, it could remove easily, and it has separated into the copper foil to which a laminate, components, and solder adhered.

[0028] Thus, by processing the printed circuit board which mounted components by the art of this invention, it becomes recoverable [metals, such as removal of components and copper foil,] easily.
[0029] (Example 3) In this example, the same component-mounting printed circuit board as an example 2 was processed as follows. first, the wire part of the resistance and the capacitor which are connected by the wire among mounting components and connection of IC chip and a connector -- the foot was cut and separation removal of the components was carried out from the printed circuit board. Then, immersion processing of the substrate from which components were removed was carried out at 80 degrees C for 20 hours at the 5-N sodium-hydroxide water solution.
[0030] Consequently, a printed circuit board swells, a resist separates completely, and, only for exfoliation, some laminates are beams. Moreover, when a part of copper foil rubbed the field only for exfoliation with the polypropylene brush for the beam reason, the exfoliation removal of the wire part and foot of copper foil, solder, and components could be carried out together, and they have separated into the metal sections, such as a phenol resin substrate and copper foil.
[0031] Thus, before processing in an alkaline water solution, a next exfoliation process can be made easy by removing mounting components beforehand.
[0032] (Example 4) In this example, after carrying out immersion processing of these at 80 degrees C for 15 hours at a 5-N sodium-hydroxide water solution using three kinds of the same printed circuit boards as an example 1, it was immersed in 80-degree C water, and processed for 3 hours.
[0033] The thickness of the substrate after each immersion processing and weight were measured. The thickness rate of change and weight rate of change of a substrate after the immersion processing to the substrate before immersion processing are shown in (Table 2).

[0034]
[Table 2]

単位：%

		紙基材フェノール	布基材フェノール	ガラス基材フェノール
厚み	7時間処理後	+283	+248	+169
変化率	水処理後	+381	+307	+212
重量	7時間処理後	+122	+101	+60
変化率	水処理後	+136	+128	+79

[0035] By comparing this result with the result of an example 1 shows carrying out that swelling [carry out / move to water and / after alkaline water-solution immersion processing, / immersion processing] is bigger, and the increment in weight rather than carrying out long duration immersion processing in an alkaline water solution. By big change of such a substrate, the part into which copper foil exfoliated also increased and separation of copper foil became easier. Every substrate has separated copper foil easily

using the pincette.
[0036] (Example 5) In this example, after being immersed in the 5-N sodium-hydroxide water solution at 80 degrees C for 15 hours using the same component-mounting printed circuit board as an example 2, it moved to 80-degree C water, and immersion processing was carried out for 3 hours.
[0037] Consequently, the printed circuit board swelled, the resist separated completely, and some laminates exfoliated. Moreover, only in exfoliation, the beam part was seen and copper foil has exfoliated [a part of copper foil] with solder easily from the exfoliation part. Therefore, the mounted components could also be removed easily and it has separated into the copper foil to which a laminate, components, and solder adhered. In addition, the ease of exfoliating of copper foil is easier than an example 2, and has been processed more in a short time.
[0038] (Example 6) In this example, separation removal of the mounting components was first carried out for the same component-mounting printed circuit board as an example 2 from the printed circuit board like the example 3. Then, after carrying out immersion processing of the substrate from which components were removed at 80 degrees C for 15 hours at a 5-N sodium-hydroxide water solution, it moved to 80-degree C water, and immersion processing was carried out for 3 hours.
[0039] Consequently, a printed circuit board swells, a resist separates completely, and, only for exfoliation, some laminates are beams. Moreover, when a part of copper foil rubbed the field only for exfoliation with the polypropylene brush for the beam reason, the exfoliation removal of the wire part and foot of copper foil, solder, and components could be carried out together, and they have separated into the metal sections, such as a phenol resin substrate and copper foil.
[0040] Since there were more exfoliation parts than an example 3, this exfoliation removal was more easy.
(Example 7) In this example, the surface coat of the same component-mounting printed circuit board as an example 2 was carried out with the coating material (trade name: HYUMI seal (BOKUSUI Brown, Inc.)) of an urethane system. This printed circuit board was moved to 80-degree C water, after being immersed in the 5-N sodium-hydroxide water solution at 80 degrees C for 20 hours, and immersion processing was carried out for 3 hours.
[0041] Consequently, the coating material exfoliated, while carrying out immersion processing at the alkaline water solution, and swelling of a printed circuit board, exfoliation of a resist, exfoliation of some laminates, etc. were seen. Moreover, only in exfoliation, the beam part was seen and copper foil has exfoliated [a part of copper foil] with solder easily from the exfoliation part. Therefore, the mounted components could also be removed easily and it has separated into the copper foil to which a laminate, components, and solder adhered. Thus, it was able to process similarly by the printed circuit board which performed coating.
[0042] In addition, in the above example, although the sodium-hydroxide water solution was used as an alkaline water solution, it is not limited to this and a potassium-hydroxide water solution, a sodium-ethoxide water solution, etc. which were mentioned above may

be used.
[0043] Moreover, although it had put on an alkaline water solution or water gently in the above example while carrying out immersion processing of the printed circuit board, a resist, exfoliation removal of coating, etc. may be performed, stirring or covering [are not limited to this approach,] a brush in liquid. Furthermore a supersonic wave and a pressure are put, the permeability of liquid may be raised or removal of mounting components etc. may be promoted.
[0044] Moreover, in the case of the printed circuit board in which components were mounted, approaches, such as carrying out melting of the solder, may be used as an approach of removing mounting components beforehand, before processing by the alkaline water solution, applying heat.
[0045] Furthermore, when not removing components, applying heat beforehand when components process the printed circuit board by which surface mounting is carried out, since components are removed from a printed circuit board together with a metallic foil, they can be divided into a printed circuit board and the metallic foil to which components adhered.
[0046]
[Effect of the Invention] As mentioned above, by carrying out immersion processing of the printed circuit board which contains phenol resin at least at an alkaline water solution, this invention can make phenol resin able to swell, can be changed into the condition of being easy to exfoliate copper foil from a substrate, and can make these separation easy.
[0047] Moreover, after being immersed in an alkaline water solution, by being immersed in water, the swelling of phenol resin is promoted using osmotic pressure difference, and the separation removal of copper foil or the components can be carried out more easily.
[0048] This art does not have generating of noise, such as the conventional crushing processing,, either, can collect metallic foils from a substrate easily, and can also perform that reuse.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The art of the printed circuit board characterized by having the process immersed in an alkaline water solution in the printed circuit board which contains phenol resin at least.
[Claim 2] The art of the printed circuit board characterized by performing immersion down stream processing that the printed circuit board which contains phenol resin at least is immersed in water after being immersed in an alkaline water solution, once [at least] or more.
[Claim 3] The art of the printed circuit board characterized by being immersed in an alkaline water solution and exfoliating said metal wiring section about the printed circuit board containing the phenol resin with which an unit or two or more components are mounted in the metal wiring section after removing said some of components [at least].

[Translation done.]